

What is claimed is:

1. A method of manufacturing a semiconductor device comprising:  
5 forming a tungsten layer pattern having an oxidized surface on a substrate;  
introducing a source gas including silicon into the oxidized surface of the tungsten  
layer pattern to form a protecting layer that prevents an abnormal growth of oxide contained  
in the oxidized surface of the tungsten layer pattern; and  
thermally treating the substrate.  
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2. The method of claim 1, further comprising forming a tungsten oxide layer on  
the oxidized surface of the tungsten layer pattern.
3. The method of claim 2, wherein the tungsten oxide layer is formed by a  
15 thermal process.
4. The method of claim 1, wherein forming the protecting layer comprises:  
maintaining a temperature of the substrate including the tungsten layer pattern in a  
range of about 300°C to about 600°C; and  
20 introducing a silane gas onto the oxidized surface of the tungsten layer pattern at a  
flow rate of about 10sccm to about 1,000sccm to react with the oxidized surface of the  
tungsten layer pattern.
5. The method of claim 1, wherein the substrate is thermally treated at a  
25 temperature of about 300°C to about 1,100°C.
6. The method of claim 1, wherein the protecting layer has a thickness of about  
1Å to about 100Å.
- 30 7. The method of claim 1, wherein forming the protecting layer further  
comprises:  
applying energy to the source gas to form silicon ions; and  
implanting the silicon ions to the oxidized surface of the tungsten layer pattern.

8. A method of manufacturing a semiconductor device comprising:  
forming a photoresist pattern on a tungsten layer formed on a substrate;  
selectively etching the tungsten layer using the photoresist pattern as an etching mask  
to form a tungsten layer pattern on the substrate;

5 removing the photoresist pattern;  
introducing a source gas including silicon onto the tungsten layer pattern to form a  
protecting layer that prevents an abnormal growth of oxide; and  
thermally treating the substrate.

10 9. The method of claim 8, wherein the photoresist pattern is removed by an  
ashing process and a stripping process.

10. The method of claim 8, wherein forming the protecting layer further  
comprises:

15 maintaining a temperature of the substrate including the tungsten layer pattern in a  
range of about 300°C to about 600°C; and

introducing a silane gas onto the tungsten layer pattern at a flow rate of about 10 sccm  
to about 1,000 sccm to react the silicon with the tungsten layer pattern.

20 11. The method of claim 8, wherein the substrate is thermally treated at a  
temperature of about 300°C to about 1,100°C.

12. The method of claim 8, wherein the protecting layer has a thickness of about  
1Å to about 100Å.

25 13. The method of claim 8, further comprising an insulating layer formed on the  
substrate including the tungsten layer pattern.